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RICS

A COMPARISON OF INTERNATIONAL AND AUSTRALIAN RATING TOOLS FOR SUSTAINABILITY ELEMENTS OF RESIDENTIAL PROPERTY

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ABSTRACT

The Australian housing sector contributes about a fifth of national greenhouse gas (GHG) emissions. GHG emissions contribute to climate change which leads to an increase in the occurrence or intensity of natural disasters and damage of houses. To ensure housing performance in the face of climate change, various rating tools for residential property have been introduced in different countries. The aim of this paper is to present a preliminary comparison between international and Australian rating tools in terms of purpose, use and sustainability elements for residential property. The methodologies used are to review, classify, compare and identify similarities and differences between rating tools. Two international tools, Building Research Establishment Environmental Assessment Methodology (BREEAM) (UK) and Leadership in Energy and Environmental Design for Homes (LEED-Homes) (USA), will be compared to two Australian tools, Green Star – Multi Unit Residential v1 and EnviroDevelopment. All four rating tools include management, energy, water and material aspects. The findings reveal thirteen elements that fall under three categories: spatial planning, occupants' health and comfort, and environmental conditions. The variations in different tools may result from differences in local prevailing climate. Not all sustainability elements covered by international rating tools are included in the Australian rating tools. The voluntary nature of the tools implies they are not broadly applied in their respective market and that there is a policy implementation gap. A comprehensive rating tool could be developed in Australia to promote and lessen the confusion about sustainable housing, which in turn assist in improving the supply and demand of sustainable housing.

Keywords: rating tool, residential property, sustainability elements.

INTRODUCTION

The housing sector contributed about one fifth of Australian's greenhouse gas (GHG) emissions in 2012 (DEHP 2012). This significantly high number of GHG emissions from human activity is linked with a changing climate and triggered more extreme weather (IPCC 2014). Increased occurrences of natural disasters, including floods and hailstorms are projected to continue with the average number of hailstorms, for example, expected to increase to up to four hailstorm days per year by 2070 in South East Queensland alone (Queensland Government 2011). These natural disasters cause

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housing damage and create a potential loss of housing value. The median house value of North Booval, Queensland, for instance, was reduced by 21% as a result of the Queensland flood in 2011 (Mardiasmo 2014). Reducing these GHG emissions and adopting sustainable practices are critical to mitigate and adapt to climate change.

This highlights the challenge of identifying sustainability elements that make housing and occupants more resilient to the changing climate and natural disasters over the life of the property. It also highlights the challenge of how such elements are evaluated and communicated to the broad housing market. In addition to regulation, some countries have introduced market driven rating tools with the purpose of enhancing society's knowledge of these issues and emphasising the importance of sustainability to ensure housing value growth in the face of climate change. It is expected that the climate and type of housing for each country will likely influence the rating sustainability elements in each country's individual rating tool.

This paper compares and contrasts the uses and sustainability elements of four rating tools that relate to residential property: Building Research Establishment Environmental Assessment Methodology (BREEAM) (UK), Leadership in Energy and Environmental Design for Homes (LEED-Homes) (USA), Green Star – Multi Unit Residential v1 (Australia) and EnviroDevelopment (Australia). The sustainability elements of these tools will be reviewed, classified, compared and contrasted, highlighting their similarities and differences. The purpose of this preliminary comparison is to engage sustainability actors and residential market players in a discussion about the development of a comprehensive and appropriate set of sustainability elements for the residential sector in Australia. This can provide a guideline for policy makers in improving the minimum requirement of sustainability elements in the current Australian National Construction Code (NCC), which commonly known by its previous name: Building Code of Australia (BCA).

THE RATING TOOLS

The rating tools discussed in this section apply to residential property. BREEAM and LEED-Homes are well-developed international rating tools. They have achieved great success in giving an indication of potential design parameters on house operation, and enhancing communication between different stakeholders and different design team members (Mao et al. 2009). The Green Building Council of Australia (GBCA) initially planned to adapt the LEED or BREEAM programs to suit Australian conditions, however cultural issues indicated that a locally-developed rating tool would be more appropriate (GBCA 2012).

BREEAM, LEED and Green Star relate to the design, construction and operation of dwelling, while EnviroDevelopment relates to residential land development, rather than house construction. A comparison between BREEAM and LEED has been shown in works by Mao et al. (2009) and Cole and Valdebenito (2013), however, did not compare other rating tools with EnviroDevelopment in the residential property sector and did not classify the sustainability elements. Reposa (2009) reviewed LEED with other rating tools but not with BREEAM and Green Star. Richumpoo et al. (2010) included EnviroDevelopment and LEED on the basis of landscape design. It was considered important to include EnviroDevelopment in this comparison, as addressing environmental issues at the concept stage and land development stage of residential neighbourhoods can minimise environmental impacts and influence building design (UDIA 2014). Both development and building rating tools can benefit developers and

homebuyers in seeking development and building approvals and in achieving long-term cost savings and minimising negative environmental impacts. Hence, it is important to compare elements of these tools to establish similarities and differences; and potentially adopt and/or combine certain sustainability elements into a comprehensive Australian rating tool or process.

BREEAM

BREEAM is an international environmental assessment and rating tool for buildings, created by the UK Building Research Establishment (BRE) (Cole and Valdebenito 2013). BREEAM evaluates a building's environmental performance and establishes the standards for building design, construction and operation (BRE Global 2011). BREEAM encourages clients and designers to focus on low carbon and minimal environmental impact design to minimise energy consumption and carbon emissions (BRE Global 2011). BREEAM's Code for Sustainable Homes assesses sustainability elements in nine categories with mandatory requirements in six categories (energy and CO_2 emissions, water, materials, surface water run-off, waste, health and wellbeing) and flexible requirements in three categories (pollution, management and ecology).

Assessment is a two stage process, at design stage (using documentary evidence) and post construction (using site records and visual inspection). A single overall score is produced by adding the section scores together. The overall score for the specific house is translated into a 1-5 scale rating, as shown in Table 1 (BRE Global 2011). A minimum rating of three is required for building approval in some UK jurisdictions and for some types of housing (e.g. social housing and government funded housing).

Table 1: Scoring of BREEAM (Adapted from BRE Global 2011)

Scale	1-Pass	2-Good	3-Very Good	4-Excellent	5-Outstanding
Scoring (%)	≥ 30	≥ 45	≥ 55	≥ 70	≥ 85

Despite its good reputation overall, the tool is not considered to be without faults. For example, BREEAM Multi-Residential Homes neglects the importance of indoor air quality considerations, such as contaminant control, pre-occupancy flush, moisture control and advice on post-occupancy indoor air quality (McGill et al. 2013).

LEED-Homes

LEED-Homes is one of the assessment tools established by United States Green Building Council (USGBC), aims to provide clean indoor air and a safe sustainable home. Single-family homes, production homes, affordable homes, existing homes, manufactured homes and multi-family units with no more than eight stories are considered for LEED-Homes certification (U.S. Green Building Council 2014).

LEED-Homes assesses sustainability elements under eight categories: innovation design process, location and linkages, sustainable sites, water efficiency, material and resources, indoor environmental quality, awareness and education, and energy and atmosphere (Abair 2008). There is scope for different regions to add or emphasise sustainability aspects pertinent to their particular region (e.g. rainwater harvesting, or solar power or landscaping to prevent erosion).

Assessment is conducted in three stages: a preliminary rating, a mid-construction verification, and final construction verification and energy performance testing. To obtain a LEED-Homes certificate, houses must pass the following tests: energy star, duct leakages, envelope air leakages and refrigerant charges (Taylor 2011). For multi-

residential projects, every unit within a project need to meet all of the criteria. LEED-Homes certification provides a total score of 136 points and the results are presented in 4 levels, as shown in Table 2 (Abair 2008).

Table 2: Scoring of LEED-Homes (Adapted from U.S. Green Building Council 2014)

Scale	Certified	Silver	Gold	Platinum
Scoring (points)	40-49	50-59	60-79	≥80

Green Star – Multi Unit Residential v1

The Green Building Council of Australia (GBCA) launched Green Star – Multi Unit Residential v1 rating tool in 2009. This rating tool aims to reduce environmental impacts and enhance financial savings to stakeholders (GBCA 2014). This rating tool is applied to new multi-unit residential facilities and major refurbishments of existing residential facilities with at least two units (Green 2009).

Sustainability of multi-unit residences is examined under nine categories, which are management, indoor environment quality, energy, transport, water, materials, land use and ecology, emissions, and innovation (GBCA 2014). GBCA provides certification to dwellings that achieve more than 4 Stars, as shown in Table 3 (GBCA 2014).

Table 3: Scoring of Green Star-Multi Unit Residential (Adapted from GBCA 2014)

Scale	4 Star	5 Star	6 Star
Scoring (%)	45-59	60-74	75-100

EnviroDevelopment

EnviroDevelopment was launched by the Urban Development Institute of Australia (UDIA) in 2011 (UDIA 2014). This rating tool focuses on enhancing a community with minimal environmental impacts and healthy lifestyles (UDIA n.d.). EnviroDevelopment aims to increase the sustainability of development projects through key rewards and partnerships. It is not a house rating tool but rather an assessment tool that reviews development projects such as Residential Subdivisions, Senior Living communities, Masterplanned Communities and Multi-unit Residential development (UDIA 2014).

EnviroDevelopment is underpinned by the EnviroDevelopment National Technical Standards which outlines the supporting documentation and assessment criteria requirements. Accreditation is allocated based on examination of sustainability elements under six key categories: ecosystems, water, waste, materials, energy and community. Essential requirements must be met by developers for getting this third-party certification. Certified projects will receive the leaf icon/s as the certification logo (UDIA 2014).

COMPARISON OF THE RATING TOOLS

Comparison of the Purpose and Use of Tools

Table 4: Comparison of Purpose and Use of Rating Tools

Comparison Items \ Rating Tool		BREEAM	LEED-Homes	Green Star	EnviroDev
Intended Management Organisation		BRE (non-profit third party)	USGBC (non-profit third party)	GBCA (non-profit third party)	UDIA (development industry)
Market-orientated		Yes	Yes	Yes	Yes
Current Implementation		Voluntary	Voluntary	Voluntary	Voluntary
Intended User		Developer, designers, building occupiers	Builders, homebuyers	Building owners, developers	Developers
Scoring/Weighting		5-scale weighting (refer Table 1)	4-scale scoring (refer Table 2)	4-6 Star rating (refer Table 3)	Leaf logo for each individual element attained
Certification	**Design**	✓	✓	✓	✓ (land)
	Construct	✓	✓	✓	
	Operate	✓	✓	✓	

Table 4 compares the management, market, implementation and use of these rating tools. It shows that all tools are market driven and voluntary, although some tools (e.g. BREEAM, LEED) are mandatory in some jurisdictions. BREEAM, LEED-Homes and Green Star are managed by non-profit third parties, whilst EnviroDevelopment is managed by the development industry itself. The certification purpose of EnviroDevelopment is also different from other three tools as it only provides certification in design stage, i.e. when the land is applying for the development approval for the land.

Comparison of Sustainability Elements

These four tools collectively include a very large number of sustainability elements under thirteen different criteria or labels. These criteria were further categorised into five broad categories identified by German academic research into property valuation and sustainability, and utilised by Germany's Sustainable Building Quality Label (Lützkendorf & Lorenz 2011). Table 5 shows the categorisation of these criteria and sub-elements: spatial planning (A), occupants' health and comfort (B), environmental condition (C), building durability (D) and operation and services (E).

Table 5: Categorisation of elements

German Category	Sustainability Elements/Criteria	Explanation/Sub-elements	BREEAM	LEED	Green Star	Enviro -Dev
A: Spatial Planning	Management	Management policy, commissioning	✓	✓	✓	✓
	Innovation and design process	Special design methods and performance levels		✓	✓	
	Land use/ Sustainable sites	Type of site and building footprint	✓	✓	✓	✓
	Transport/Location and linkages	Transport-related (CO_2 and location)	✓	✓	✓	
B: Occupants Health and Comfort	Community	Community engagement/neighbourhood		✓		✓
	Indoor environmental quality/ Health and wellbeing	Improvement of indoor air quality (noise, light, air, quality)		✓	✓	
	Awareness and education	Operation and maintenance of the green features		✓		
	Materials	Embodied impacts	✓	✓	✓	✓
C: Environm-ental Condition		Efficient use of materials	✓	✓	✓	✓
		Environmentally preferable materials/reuse initiatives		✓	✓	
	Waste	Operational waste management and minimisation	✓	✓		✓
	Water	Efficiency and water reuse	✓	✓	✓	✓
	Pollution/Emissions	Air and water pollution	✓		✓	✓
	Ecology	Ecosystem health, conservation of site	✓		✓	✓
	Energy	Operational energy and CO_2	✓	✓	✓	✓
D: Building Durability	-	-	-	-	-	-
E: Operation & Services	Awareness and education	-	-	✓	-	-

The table shows that these four rating tools collectively include four sustainability elements that can be classified in the spatial planning category (A), i.e. they incorporate characteristics of the development process and aspects of how the site is used. Comparison of the inclusion/exclusion of these four elements, by each of the four rating tools, reveals that LEED and Green Star included all the elements.

Four sustainability elements can be classified in the occupants' health and comfort category (B). LEED-Homes has the most complete set of elements in this category. BREEAM, Green Star and EnviroDevelopment do not include awareness and education. This is a good element to consider for ongoing operation of homes and for market acceptance. Although all four rating tools included embodied impacts,

EnviroDevelopment relates this aspect to the recycling/reuse of vegetative on a greenfield development site, whilst the other three tools are referring to the embodied impact of building materials at construction. The four rating tools collectively include six sustainability elements that can be classified in the environmental conditions category (C). The result shows Green Star covers the majority of the elements, excluding waste.

None of the four rating tools has sustainability elements that address building durability (D) or operation and services (E) category, although LEED's awareness and education could be considered as an element of the operation and services category. Some elements that currently account for 'innovation' point (e.g. adaptability, durability), may contribute in future to Category D and Category E.

DISCUSSION

Three key issues arise from the comparison: the selection of sustainability elements, the assessment process, and market implementation. Each tool differs in what sustainability elements are incorporated into each tool. Variations in regional climate may explain some of these differences. For example, Australia has lower temperature fluctuations compared to US and UK, perhaps one explanation for the significantly lower energy efficiency requirements for Australian houses compared to their international counterparts (Horne and Hayles 2008). The sustainability elements covered by EnviroDevelopment are also quite different from BREEAM, LEED and Green Star. Due to its concentration on the concept planning and land development stages, this tool acknowledges the importance of the multitude of decisions made before houses are built. All sustainability elements are not considered equally. BREEAM, LEED and Green Star have weighting systems to indicate the relative importance of some sustainability elements compared with others.

The tools also differ in their assessment processes. All tools rely heavily on project documentation confirming the application of specific sustainability elements. Only LEED and BREEAM contain some level of quantifiable performance assessment. Green Star is moving to incorporate assessment of the design, construction and operation performance under various sustainability categories. EnviroDevelopment is different from other three tools in its certification process. BREEAM, LEED and Green Star provide certification only if a house meets all of the sustainability elements. Apart from minimum requirements for all developments, EnviroDevelopment allows developers to choose one or more element for accreditation (i.e. water, ecosystem, energy, community, materials or waste).

All four rating tools are market-orientated and used in a voluntary basis, although some tools have been adopted by regulators in certain regions. These tools were developed as a market approach to reward innovation that provided sustainability elements beyond minimum regulation. Tool developers hoped to encourage and enable developers, designers and owners to find the practical benefits and market value of sustainable housing. The voluntary nature of the tools, however, means that they are not broadly applied in any of their respective markets. There is also little evidence that the residential property market, particularly real estate, utilise these tools as a mean of communicating the sustainability elements of individual properties.

The Australian NCC includes limited sustainability elements in establishing the minimum six-star energy efficiency standard for residential property (ABCB 2010).

The energy efficiency is measured by building fabric and ventilation, to maintain comfortable temperatures for occupants (Category B only). This implies that the current Australian policy does not include sustainability elements as covered by other market rating tools, hinting at a policy gap. This gap may be due to the policy makers' confusion on which sustainability elements are important.

CONCLUSIONS

This analysis has shown that Australia's rating tools: Green Star–Multi Unit Residential v1 and EnviroDevelopment, are not as comprehensively developed as BREEAM and LEED-Homes. The comparison has also shown that neither of the two Australian tools relates to detached housing, nor relate to each other. Australian housing should have more sustainable practices to mitigate against climate change and extreme weather events. Sustainability rating tools appear to be a reasonable approach to identifying important sustainability elements relevant to particular communities and assessing the extent to which individual properties provide these elements. Much more work, however, is needed by the whole housing market to determine a comprehensive list of desirable sustainability elements that are responsive to Australian climate, environmental challenges and culture. This comprehensive list of sustainability elements will reduce confusion and provide policy regulators with suggestions for elements to be included into the policy. Expanding the minimum requirements of current NCC may lead to the development of more sustainable housing as the construction industry is mostly reluctant to go beyond the minimum regulatory requirements. A further step would be developing a method of implementing, evaluating and communicating these elements to all parties.

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